Lower Chickahominy River and Tributaries Bacteria TMDL Technical Advisory Committee (TAC) Meeting

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Why We Are Here

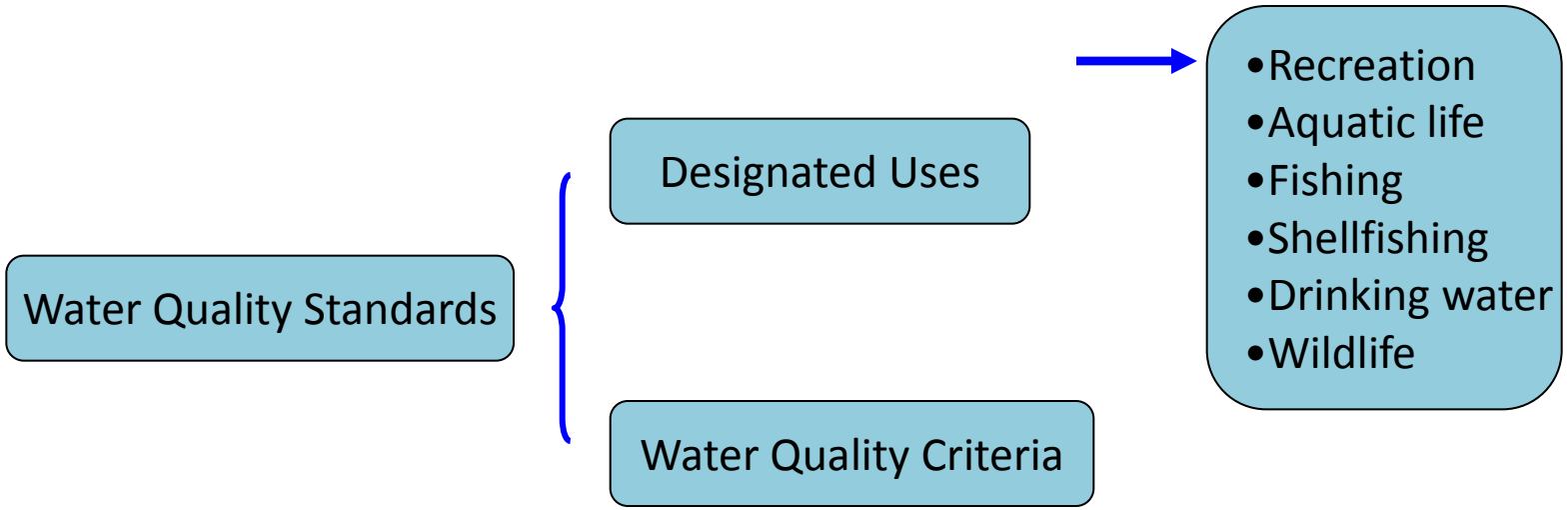
1. To review the draft source assessment estimates
2. To gather feedback and technical advice
3. To discuss the next steps of TMDL development

Outline

- Review the TMDL process
- Impaired waters and pollutants
- Source assessment methods and draft results
- Discussion

The TMDL Process

- DEQ routinely monitors the quality of waters across the state and publishes a list of impaired waters every 2 years
- Virginia is required by law to establish a TMDL for each pollutant causing an impairment
- A TMDL is the amount of a particular pollutant that a stream can receive and still meet Water Quality Standards
- Water quality standards are regulations based on federal or state law that set numerical or narrative limits on pollutants



What is a TMDL ?
Total Maximum Daily Load

A TMDL is the amount of a particular pollutant that a stream can receive and still meet Water Quality Standards
AKA "Pollution Diet"

TMDL = Sum of WLA + Sum of LA + MOS

Where:

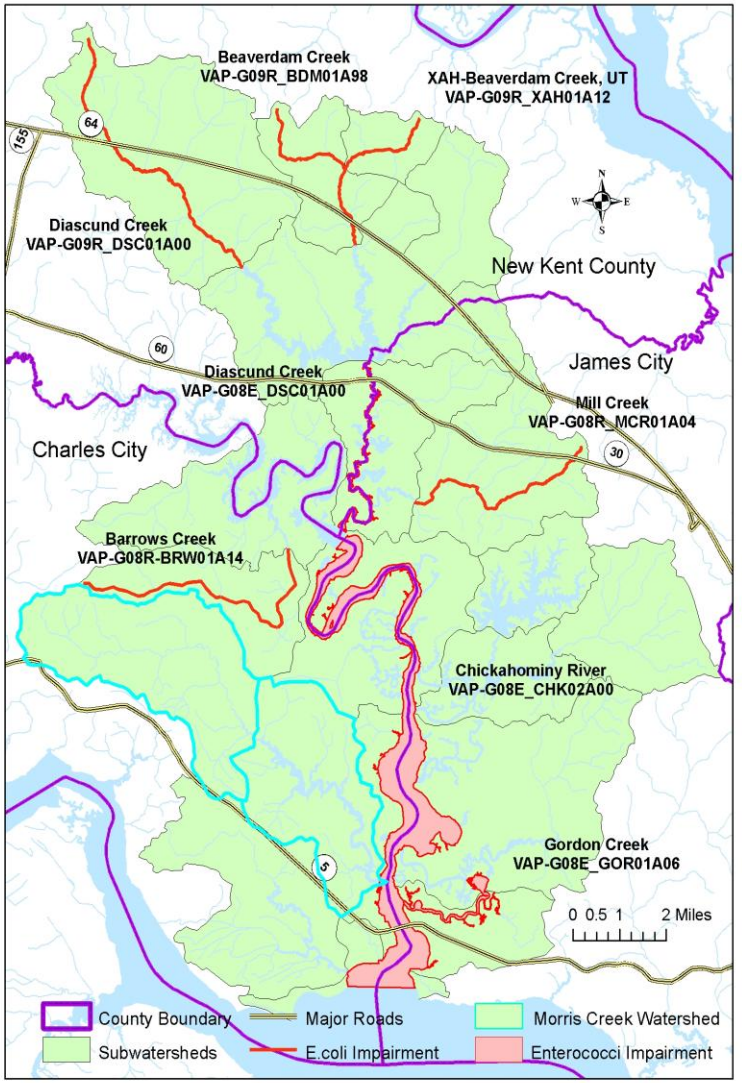
TMDL	**=**	**Total Maximum Daily Load**
WLA	**=**	**Waste Load Allocation (point sources)**
LA	**=**	**Load Allocation (nonpoint sources)**
MOS	**=**	**Margin of Safety**

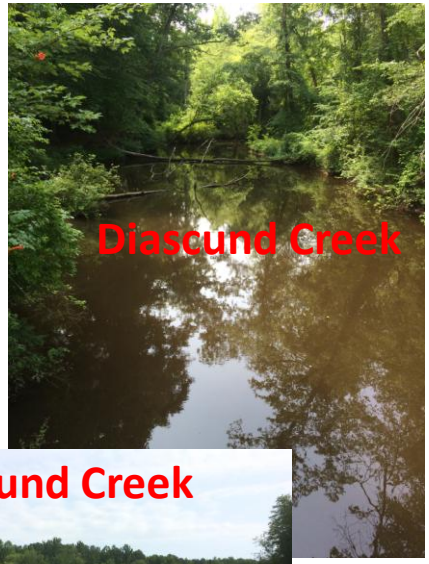
Current Load = current loads discharged to the water body, which will be determined during this study

Reduction = (current load –TMDL)/ current load x 100%

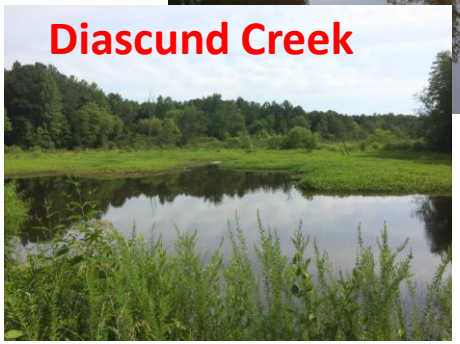
Impaired waters and pollutants

- Lower Chickahominy River and seven tributaries are Impaired for elevated bacteria levels
- The Morris Creek bacteria TMDL study was completed in 2009. Its results (source, current loading, and TMDL) will be used by this study.




Diascund Creek


Beaverdam Creek


Diascund Creek


Beaverdam Creek

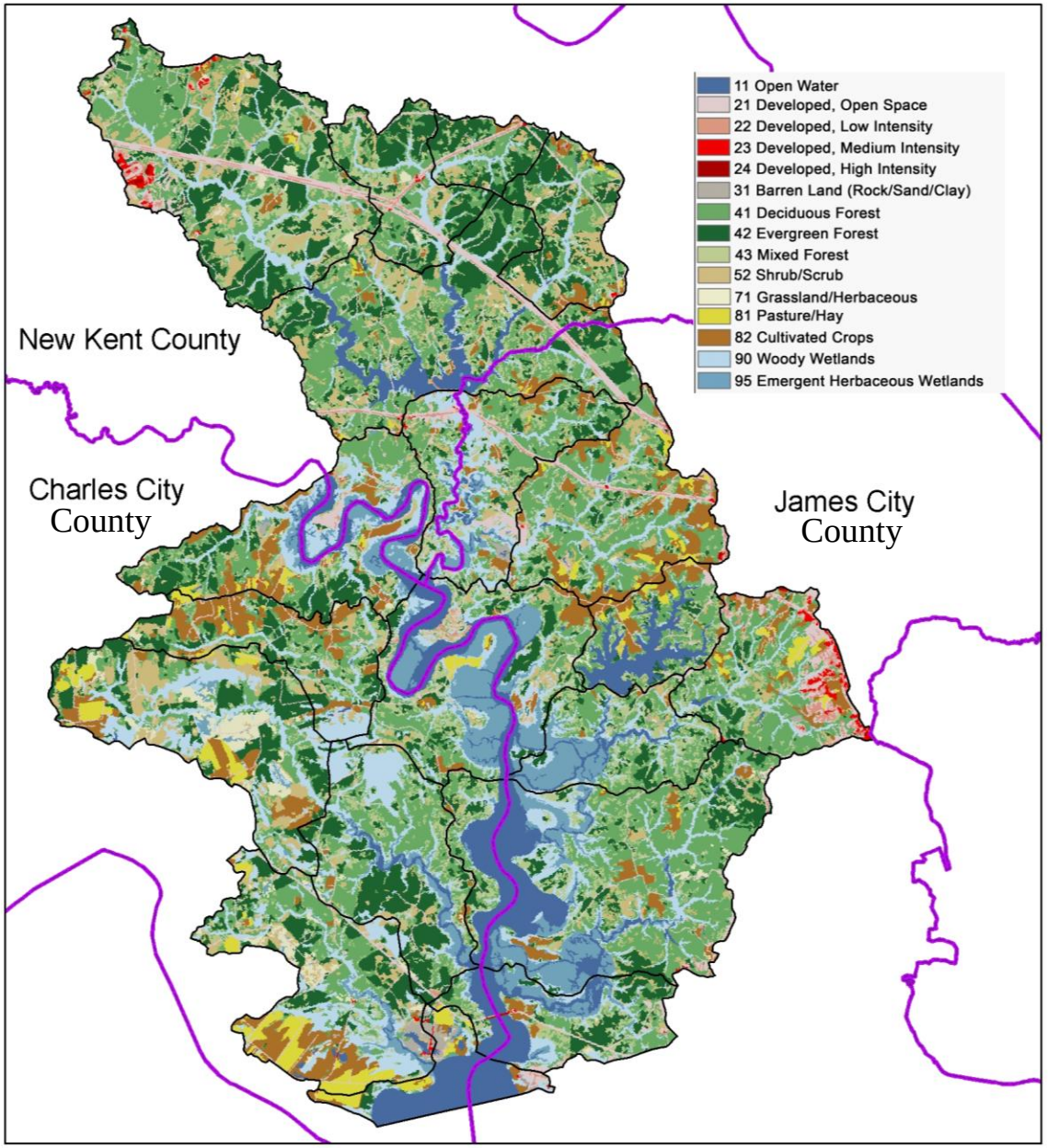

Mill Creek


Barrows Creek

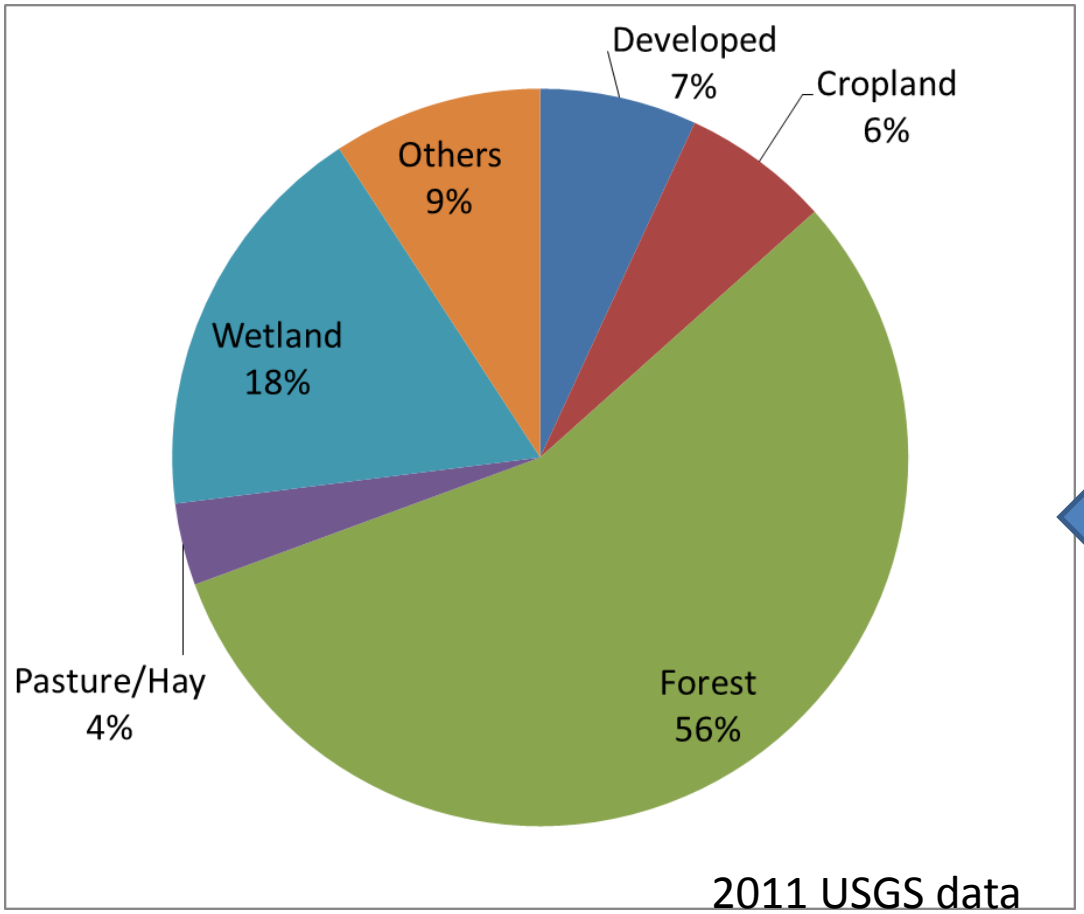

Chickahominy River

Land Use

(USGS NLCD 2011 data)



Land Use Distribution

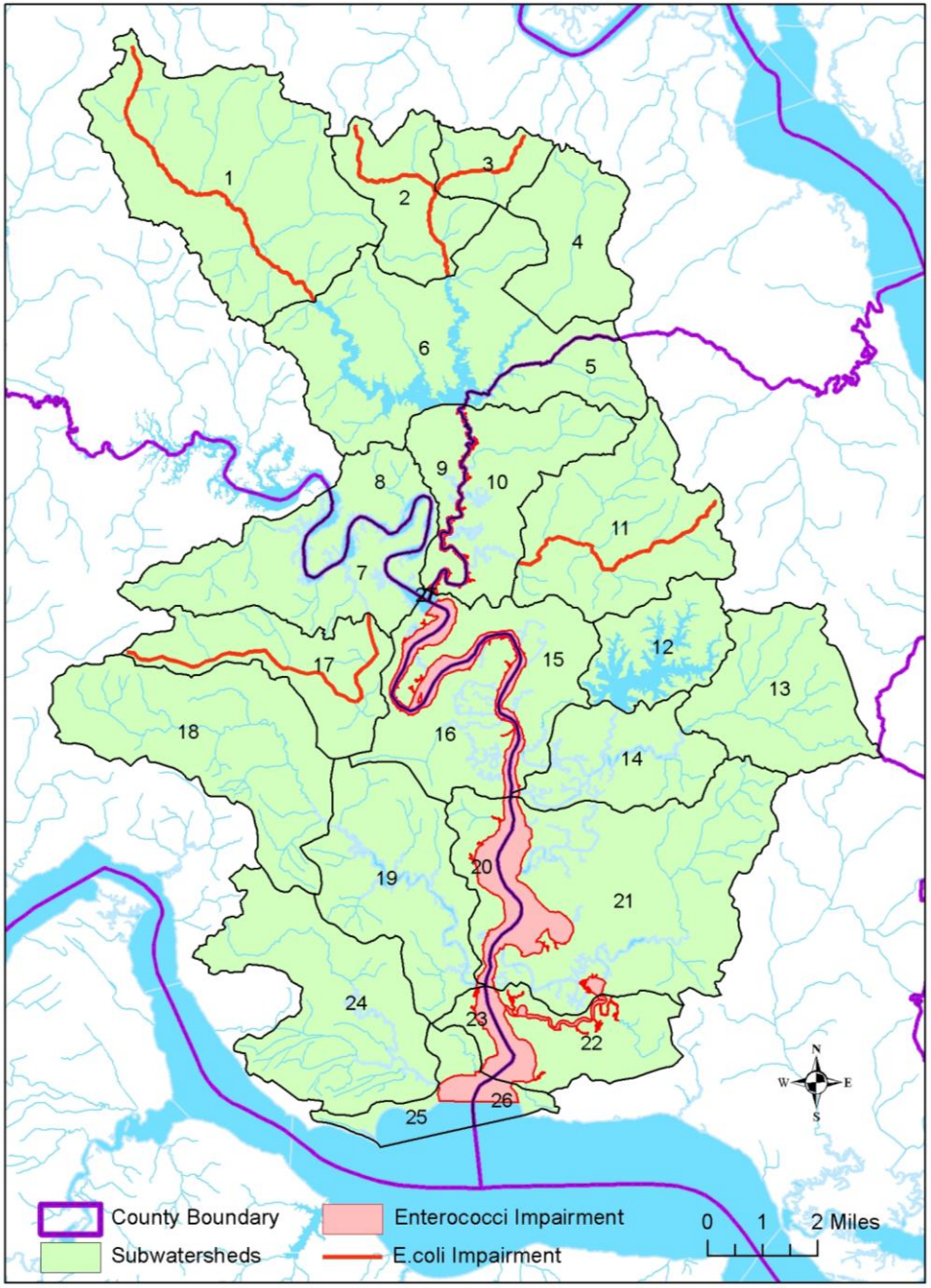


Undeveloped = 74%
Ag. = 10 %
*Others: Includes Water and Barren Land (Rock, Sand, and Clay)

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands

Subwatershed Delineation for Source Assessment and Modeling Purposes.
There are a total of 27 segments

Area	Subwatersheds
Chickahominy River	1-27
Diascund Creek (nontidal)	1
Beaverdam Creek	2
UT Beaverdam Creek	3
Diascund Creek (tidal)	1-6,9-11
Mill Creek	11
Barrows Creek	17
Gordon Creek	22
Charles City County	7, 16-20, 23-25
James City County	5, 10-15,21,22,26
New Kent County	1-4, 6, 8, 9, 27



Procedures of Source Assessment

- Sources
  - Point Source: any discernible, confined and discrete conveyance, from which pollutants are or may be discharged.



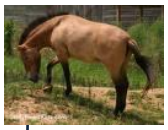

  - Non-point Source: any source of water pollution that does not meet the legal definition of "point source".
    - Agricultural/Livestock
    - Humans
    - Pets
    - Wildlife



- Approach
  - GIS data (land use, population, pets, septic systems, pervious and impervious, roads, etc.)
  - Field survey
  - Census of Agriculture data
  - Wildlife survey data (animal density, animal habitat)
  - DEQ and DCR database (point source, nutrient management, AFO, CAFO)
  - Virginal Health Department (SSO, shoreline survey)
  - Public inputs/Public meeting/Interview with local citizens

Potential Sources

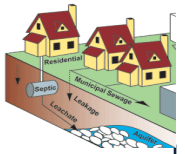












Pasture

Cropland

Forest/Wetland

Developed

Runoff

Stream






Non-Point Source

1. Human Source---household waste

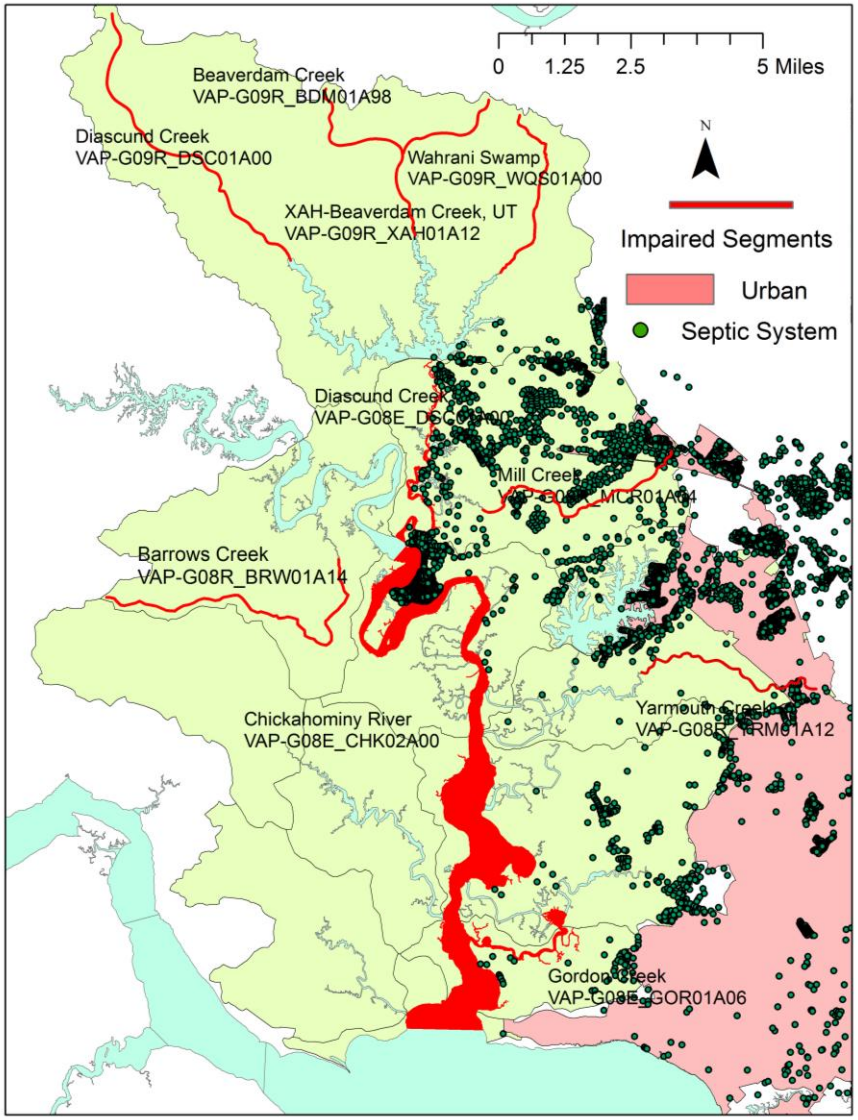
Septic Tank and Septic Tank Failure Estimation

- Estimate based on population
- Estimate based on GIS layers provided by city and county
- Estimate based on building addresses provided by county

We will determine the appropriate estimation from among these methods based on available data for each county

James City County

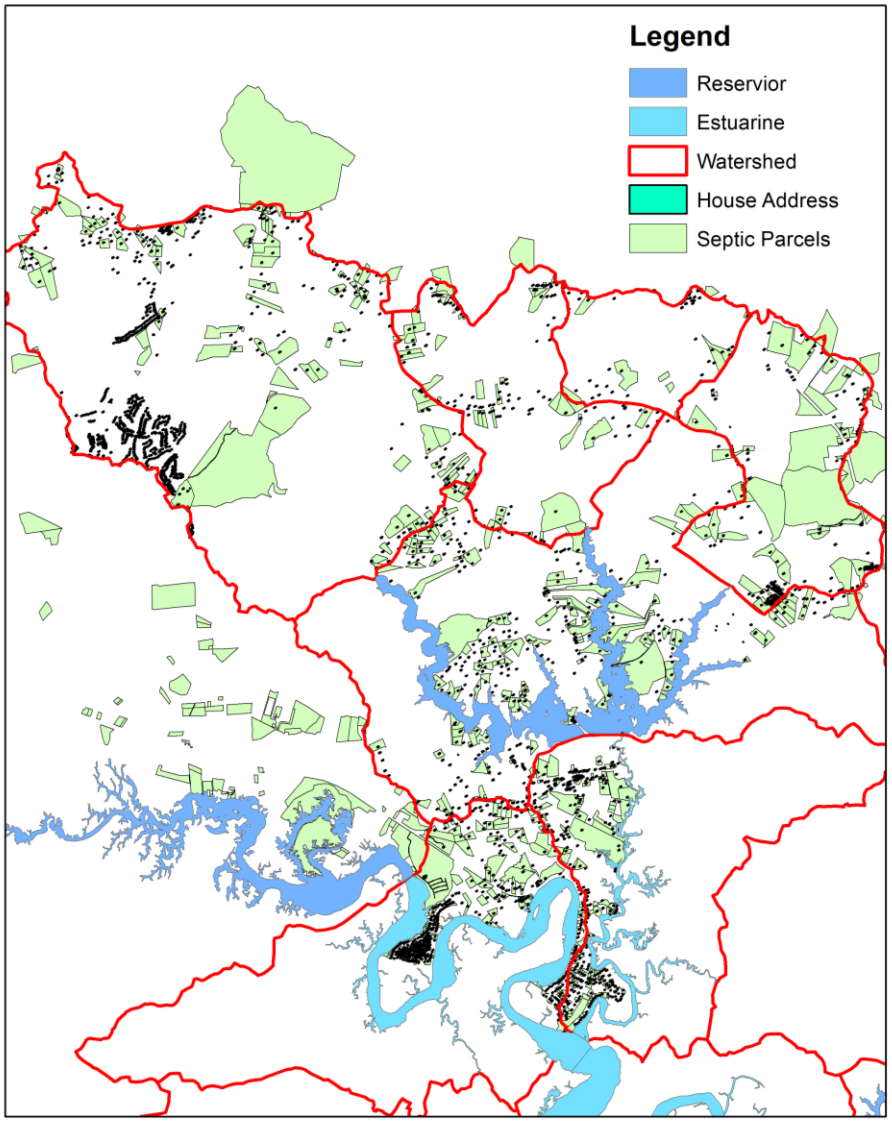
- Estimation of the number of septic tanks in each subwatershed is based on the GIS layer provided by the county.
- The total number of septic tanks is 2,361.
- A small portion of “urban” land area is associated with storm water management.



New Kent County

- Estimation of the number of septic tanks in each subwatershed is based on the GIS layer provided by the county.
  - Estimation of the total number of buildings is about 5,300. This number is larger than the population. More information is needed to refine this estimation.
  - Estimated total house addresses (septic tanks) is about 2,189.

- Estimation of the number of septic tanks in each subwatershed is based on population.
  - Obtain the # of households and # of persons/household (http://censtats.census.gov/cgi-bin/usac/usatable.pl)
  - # households in each subwatershed = # households in county / developed area in county * developed area in subwatershed
  - 1 household = 1 septic tank
  - Estimated total number of septic systems is about 1,949.



Charles City County

- Estimation of the number of septic tanks in each subwatershed is based on addresses provided by the county.
  - There are about 650 addresses. We are geocoding locations to determine subwatershed locations.

- Estimation of the number of septic tanks in each subwatershed is based on population.
  - Obtain the # of households and # of persons/household (http://censtats.census.gov/cgi-bin/usac/usatable.pl)
  - # households in each subwatershed = # households in county / developed area in county * developed area in subwatershed
  - 1 household = 1 septic tank
  - Estimated total number of septic systems is about 748
  - If using Morris Creek bacteria TMDL result, the estimated number of total septic systems is 646.

For All 3 Counties

After obtaining the number of septic tanks in the county…

1. # Failing septic tanks = # septic tanks * failure rate (10% is used based on James City County data)
2. # people served = # Failing septic tank * # person/household
3. Septic Flow = # people served * Septic overcharge flow rate (70 Gal/Person/Day, Horsely & Whitten 1996)
4. Fecal coliform Loading (Counts/Day) = Septic Flow * Septic Overcharge Concentration

Concentration: 1.0×10^{6} #/100ml (MapTech 2001) √

1.0×10^{4} #/100ml (USEPA)

5.5×10^{6} - 2.5×10^{6} #/100ml (HRSD, city SSO)

Non-Point Source

1. Human Source --- boating activity/marina

1. Obtain boat locations and # of slips *(VDH Marina Program)*

   -Total slips = 145

   -70 located in Charles City and 75 located in New Kent County

2. Assumptions: *(VDH; Poquoson River TMDL, VA-DEQ 2014)*

   - An average of 3 persons per slip;
   - Only 10% of the slips contribute to the loading;
   - A production rate of 2.0E+09 counts/day/person

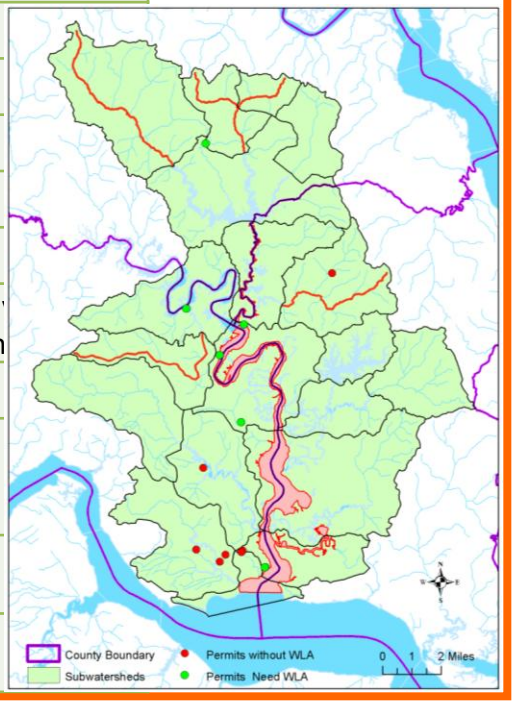
3. Fecal Coliform Loading (Counts/Day) =

*# Slips * 10% * 3 (persons) * 2.0×10^9 (counts/day/person)*

Point Sources

1. Human source - VPDES Permits

Permit #	Facility	Permit Type	Bacteria WLA Needed?	Receiving Waterbody
VA0080233	Hideaway STP	Minor Municipal (POTW)	yes	Chickahominy River
VA0085936	Mt. Zion - Rustic WTP	Minor Industrial	no	Morris Creek
VAG110166	Branscome, Inc. – Charles City Concrete	General Permit	no	Chickahominy River, UT
VAG110166	Branscome, Inc. – Charles City Concrete	General Permit	no	Chickahominy River, UT
VAG403039	Single Family Home	General Permit	yes	Chickahominy River
VAG404050	Single Family Home	General Permit	yes	Chickahominy RIver
VAG404144	Single Family Home	General Permit	yes	Chickahominy River
VAG404152	Single Family Home	General Permit	yes	Chickahominy River
VAG404198	Single Family Home	General Permit	yes	Chickahominy River
VAG840116	Hofmeyer Pit	General Permit	no	Tomahund Creek
VAG840116	Hofmeyer Pit	General Permit	no	Tomahund Creek
VAG840135	Sandy Point Sand & Gravel	General Permit	no	Tomahund Creek (onl 003 flows to Tomahun
VAG404284	Single Family Home	General Permit	yes	Timber Swamp, UT
VAR051899	Total Area of facility 4.3 acres, Area of industrial activity 1.4 acres.	General Permit	no	Edwards Swamp
VAR040037	Locality urbanized service area – James City	General Permit	yes	Various
VAR040115	VDOT roads within James City County	General Permit	yes	Various



Point Source

1. Human Source ---SSOs

Permit No	Permitee	Date of SSO	Waterbody	SSO Amount (Gallons)
VA0080233	Hideaway STP	2/5/2010	Morris Creek	500-1000
VA0080233	Hideaway STP	8/27/2011 -9/1/2011	UT or Chickahominy River	1400-20000
VA0080233	Hideaway STP	7/31/2013 -8/5/2013	Ut to Chickahominy River	22500
VA0080233	Hideaway STP	11/20/2013	Morris Creek	None reported
VA0080233	Hideaway STP	9/25/2013	Morris Creek	250
VA0080233	Hideaway STP	1/29/2014	Morris Creek	350
VA0080233	Hideaway STP	3/8/2014	Morris Creek	None reported
VA0080233	Hideaway STP	9/3/2014	Morris Creek	Not provided
VA0088331	Parham Landing	3/24/2011	UT of the Chickahominy Reservoir	700

The Poquoson River TMDL (VADEQ, 2014) SSO fecal coliform concentrations used:

Table 3.3: Fecal Coliform Information for SSOs in the Poquoson River Watershed

Area	Number of Spills	95% Volume (Gallons)	Raw Sewage Concentration (MPN/100ml)	Non-Raw Sewage Concentration* (MPN/100ml)	m^3	Fecal Coliform (Counts/Day)
1	18	18,750	2,700,000	500,000	70.98	7.453E+11
2	4	185	2,700,000	500,000	0.70	7.353E+09

Non-Point Source

2. Pets (Dogs)

1. Obtain # dogs (i.e., # of licenses) (from the County Treasurer Office)
2. # Dogs in Subwatershed = # Dogs in County / County urban area * Subwatershed urban area

County	# of Dogs within the Chickahominy Watershed
Charles City	781*
James City	464
New Kent	891

3. Fecal Coliform Loading (Counts/Day) = Production Rate (4.0E+09 counts/animal/day, LIRPB 1978) * # Dogs in Subwatershed
4. Only 23% of the total dog feces are subject to runoff (from Poquoson River TMDL, VA-DEQ 2014)

* The dog number in the Charles City portion of the Chickahominy watershed used the Morris Creek bacteria TMDL result.

Non-Point Source

3. Wildlife --- Deer

1. Obtain an average deer index by county (Virginia Deer Management Plan 2006-2015 http://www.dgif.virginia.gov/wildlife/deer/management-plan/virginia-deer-management-plan.pdf)
2. # deer/mi^2 of deer habitat = (-0.64 + (7.74 * average deer index)) (Morris Creek TMDL, VA-DEQ 2009; DGIF)

County	Deer Index	# /mile^2
Charles City	4.3	33
James City	3.4	26
New Kent	4.1	31

3. The deer habitat is the entire watershed, except open water and urban
4. # Deer in each sub watershed = # Deer/mi2 * Habitat Area in Subwatershed
5. Fecal Coliform Loading (Counts/Day) = # Deer * Production Rate (5.00E+08 Counts/Animal/Day, Best Professional Judgment)

Non-Point Source

3. Wildlife --- Beavers

1. Average beaver density (4.8 /River Mile) was supplied by DGIF

2. # Beavers in each subwatershed = Average density * Total River Miles of the subwatershed

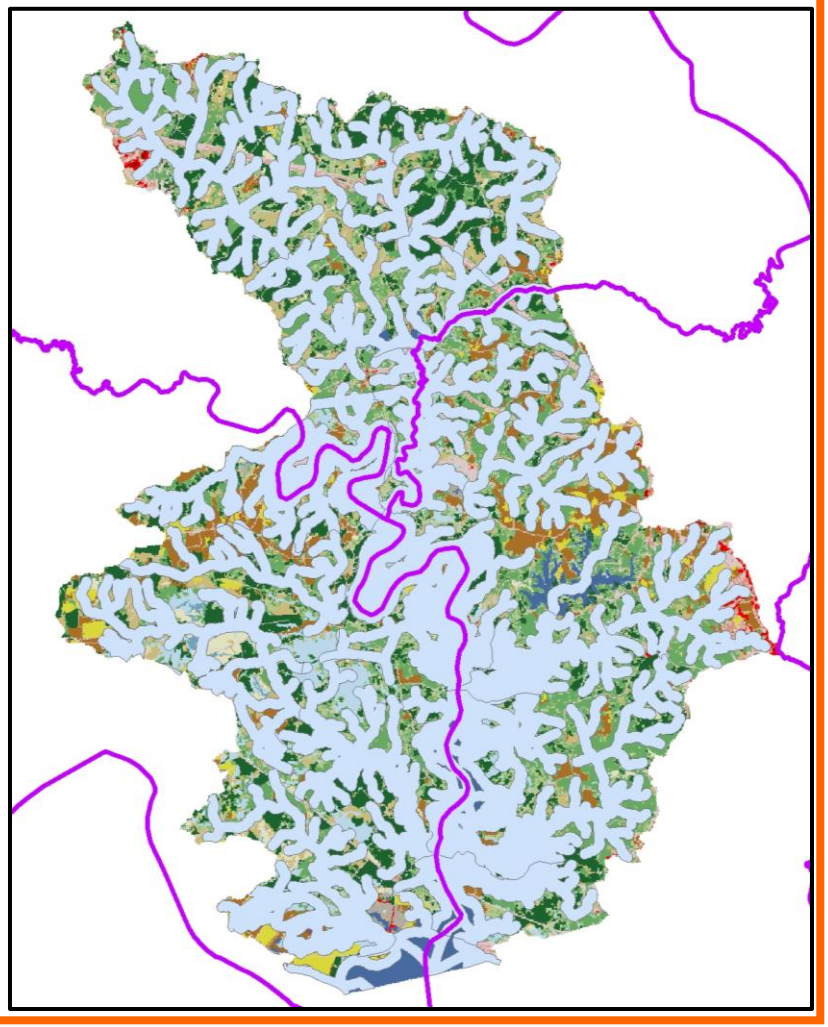
3. Fecal Coliform Loading (Counts/Day) = # Beavers * Production Rate (2.5E+08 Counts/Animal/Day, Morris Creek TMDL, VA-DEQ 2009)

Non-Point Source

3. Wildlife --- Raccoons

1. Build a 600-ft buffer along the streams and ponds
2. Raccoon habitats are wetlands and forest
3. Different densities inside (0.078/acre) and outside of the buffer (0.016/acre) (Morris Creek TMDL, VA-DEQ 2009)
4. # of Raccoons = (Habitat area inside the buffer * density inside) + (Habitat Area outside of the buffer * density outside)
5. Fecal Coliform Loading (Counts/Day) =

   # of Raccoons * Production Rate (1.25E+08 Counts/Animal/Day, Best Professional Judgment)



Non-Point Source

3. Wildlife --- Muskrats

1. Muskrat habitat is wetland only
2. Density: 10/acre (Morris Creek TMDL, VA-DEQ 2009)
3. # of Muskrats = Habitat Area * Density
4. Fecal Coliform Loading (Counts/Day) = # of Muskrats * Production Rate (3.40E+07 Counts/Animal/Day, York River TMDL, VA-DEQ 2007)

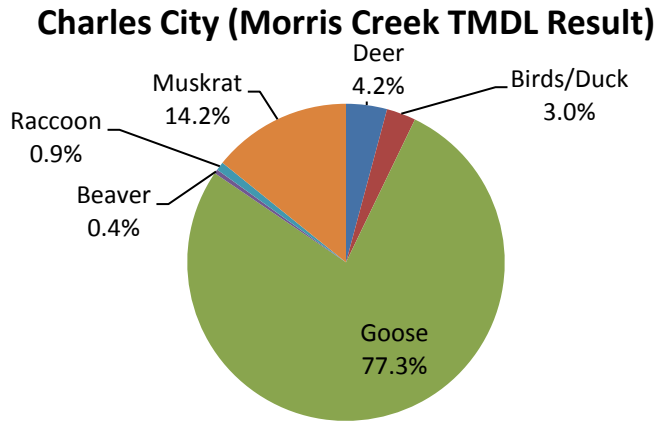
Non-Point Source

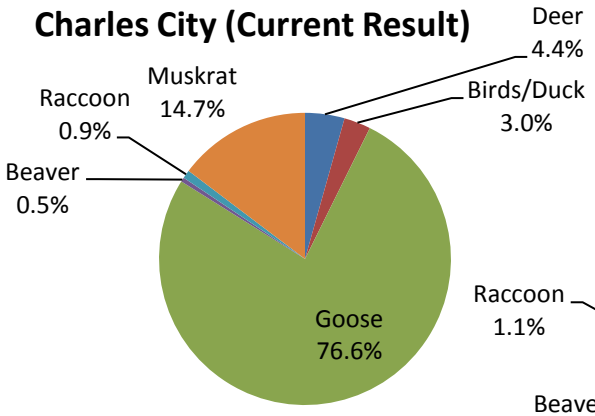
3. Wildlife --- Geese and Duck

- Obtain the average goose density of 1.969/km^2 and duck density of 1.532/km^2 (Migratory Bird Data Center https://migbirdapps.fws.gov/)
- Habitat is the entire watershed for both
- # Geese (Ducks) in each subwatershed = Goose (Duck) Density * Subwatershed Area
- Loading (Counts/Day) = # Geese (Ducks) * Production Rate
  - 4.90E+10 Counts/Animal/Day for geese (LIRPB 1978)
  - 2.43E+09 Counts/Animal/Day for ducks (ASAE 1998)

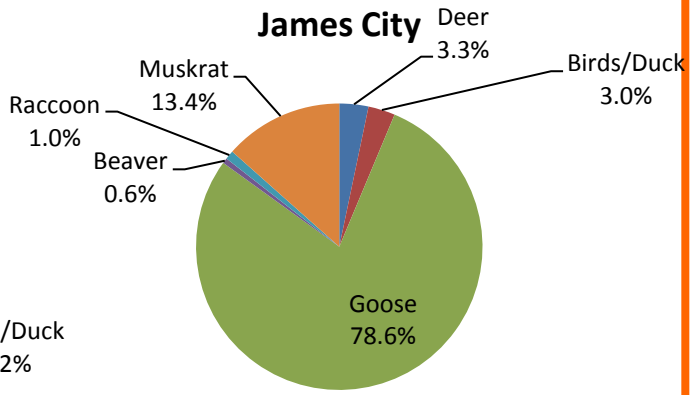
Summary of Wildlife Numbers by County

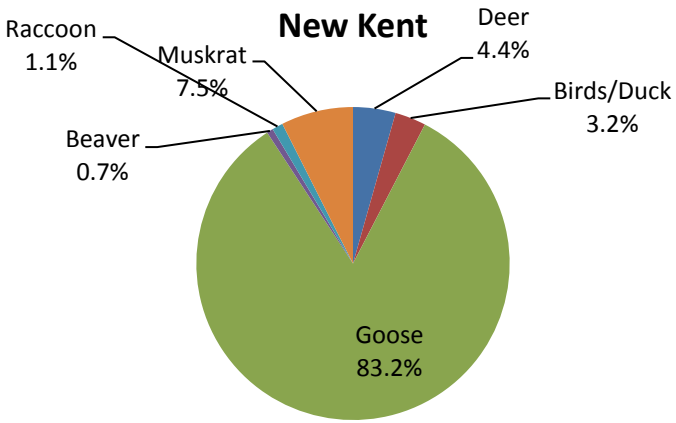
Source		Charles City (Current Estimation)	Charles City (Morris Creek TMDL Results)	James City	New Kent
Wildlife	Deer	1,612	1,426	1,314	1,231
	Duck	224	194	250	185
	Goose	288	250	321	238
	Beaver	355	265	483	371
	Raccoon	1,363	1,320	1,608	1,256
	Muskrat	79,702	58,642	79,133	30,713
	Total	83,543	62,098	83,108	33,993





Relative Loadings





Summary of Wildlife Numbers by Impaired Water

Source		Diascund Creek (Non-tidal)	Beaverdam Creek	XAH-Beaverdam Creek, UT	Diascund Creek (Non-tidal)	Mill Creek
Wildlife	Deer	434	135	64	434	221
	Duck	63	19	9	63	38
	Goose	81	25	12	81	48
	Beaver	33	21	11	33	23
	Raccoon	449	136	65	449	241
	Muskrat	8,220	2,893	1,381	8,220	6,665
	Total	9,281	3,230	1,543	9,281	7,237

Source		Barrows Creek	Chickahominy River (Current Estimation)	Chickahominy River (Morris Creek Result)	Diascund Creek (Tidal)	Gordon Creek
Wildlife	Deer	192	4,156	3,971	1,575	93
	Duck	25	659	629	245	19
	Goose	32	847	809	315	25
	Beaver	32	1,209	1,120	393	67
	Raccoon	133	4,226	4,184	1,660	110
	Muskrat	5,667	189,547	168,488	42,675	7,995
	Total	6,079	200,645	179,199	46,863	8,308

Non-Point Source

4. Livestock

1. Obtain the # livestock in each county (USDA, National Agricultural Statistics Service, 2012 Census of Agriculture)
2. # livestock in subwatershed = # livestock in county / area in county * area in subwatershed
3. Loading by grazing (Counts/Day) = # animals * time fraction spent on grazing * Production Rate
4. Loading by manure application (Counts/Day) = # animals * time fraction spent in feedlots * Production Rate

Non-Point Source

4. Livestock - Continued

Livestock	Habitat	Manure Application Area	Production Rate (Counts/Animal/Day)
Horse*	Pastureland, feedlots	Pastureland	4.20E+08
Beef Cattle	Pastureland, feedlots	Pastureland, cropland	1.04E+11
Milk Cattle	Feedlots	Pastureland, cropland	1.01E+11
Swine	Feedlots	Cropland	1.08E+10
Chicken	Feedlots	Cropland	1.36E+08
Sheep	Pastureland, feedlots	Pastureland	1.20E+10

*Horses aren't technically a "livestock" animal. Costshare for horse BMPs tends to be more limited than for typical livestock animals.

Summary of Livestock Numbers - by Impaired Water

Using GIS method and agriculture census data, the estimated livestock in each listed area is as follows. These numbers should be validated.

Impaired Water	Cattle (Beef)	Cattle (Milk)	Pig	Chicken	Horse	Sheep	Sum
Chickahominy River (Current Result)	262	62	26	739	232	38	1,360
Chickahominy River (using Morris Creek Result)	236	62	23	709	212	213	1,455
Diascund Creek (Non-tidal)	29	0	2	97	17	6	151
Beaverdam Creek	7	0	1	29	4	1	43
Beaverdam Creek, UT	1	0	0	14	0	0	15
Diascund (Tidal)	93	25	9	372	92	12	603
Mill Creek	30	22	2	68	51	1	174
Barrows Creek	6	0	1	18	3	1	29
Gordon Creek	1	1	1	21	2	0	26

Summary of Livestock Numbers - by County

	Cattle (Beef)	Cattle (Milk)	Pig	Chicken	Horse	Sheep	Sum
Charles City (Current Result)	117	0	9	128	53	24	331
Charles City (Morris Creek Result)	91	0	6	98	33	200	426
James City	85	61	12	349	144	2	653
New Kent	60	1	5	262	36	12	375

Horse estimation could be low based on state averaged number.
These initial estimations require validation.

- Some additional information is available from DCR (http://www.dcr.virginia.gov/soil_and_water/animals.shtml)
- Based on DCR livestock density maps
  - There are no chickens nor milk cattle in the Chickahominy watershed.
  - There are some cattle in the watershed, which needs validation.
  - There are no CAFO or AFOs.
  - No pig information.

Summary of Source Assessment -- by Impaired Water

Source		Diascund Creek (Non-tidal)	Beaverdam Creek	XAH-Beaverdam Creek, UT	Mill Creek	Barrows Creek
Wildlife	Deer	434	135	64	221	192
	Duck	63	19	9	38	25
	Goose	81	25	12	48	32
	Beaver	33	21	11	23	32
	Raccoon	449	136	65	241	133
	Muskrat	8,220	2,893	1,381	6,665	5,667
	Total	9,281	3,230	1,543	7,237	6,079
Pet	Dogs	371	101	47	82	78
Septic		812	220	104	400	119
Marina		-	-	-	-	-
Livestock	Beef Cattle	29	7	1	30	6
	Pig	2	1	0	2	1
	Milk Cattle	0	0	0	22	-
	Chicken	97	29	14	68	18
	Horse	17	4	0	51	3
	Sheep	6	1	0	1	1
	Total	151	43	15	174	29
Total		10,615	3,954	1,709	7,893	6,305

Note livestock estimations require confirmation and ground validation.

Summary of Source Assessment -- by Impaired Water

Source		Chickahominy River (Current Estimation)	Chickahominy River (Morris Creek Result)	Diascund Creek (Tidal)	Gordon Creek
Wildlife	Deer	4,156	3,971	1,575	93
	Duck	659	629	245	19
	Goose	847	809	315	25
	Beaver	1,209	1,120	393	67
	Raccoon	4,226	4,184	1,660	110
	Muskrat	189,547	168,488	42,675	7,995
	Total	200,645	179,199	46,863	8,308
Pet	Dogs	1,843	2,136	998	27
Septic		5,059	4,956	2,714	41
Marina		145	145	-	-
Livestock	Beef Cattle	262	236	93	1
	Pig	26	23	9	1
	Milk Cattle	62	62	25	1
	Chicken	739	709	372	21
	Horse	232	212	92	2
	Sheep	38	213	12	-
	Total	1,360	1,455	603	26
Total		**209,052**	**187,891**	**51,178**	**8,402**

Summary of Source Assessment -- by County

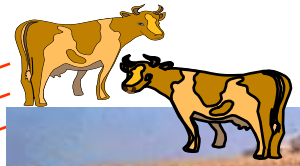
Source		Charles City (Current Result)	Charles City (Morris Creek Result)	James City	New Kent
Wildlife	Deer	1,612	1,426	1,314	1,231
	Duck	224	194	250	185
	Goose	288	250	321	238
	Beaver	355	265	483	371
	Raccoon	1,363	1,320	1,608	1,256
	Muskrat	79,702	58,642	79,133	30,713
	Total	83,543	62,098	83,108	33,993
Pet	Dogs	488	781	464	891
Septic		748	646	2,361	1,949
Marina		70	70	-	75
Livestock	Beef Cattle	117	91	85	60
	Pig	9	6	12	5
	Milk Cattle	0	0	61	1
	Chicken	128	98	349	262
	Horse	53	33	144	36
	Sheep	24	200	2	12
	Total	331	426	653	375
Total		**85,183**	**64,021**	**86,586**	**37,284**

Watershed Model Approach

Non-Point Source

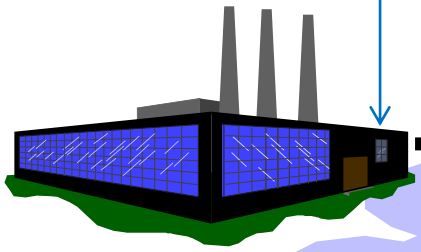
Tributary Contribution

Estimated loading will add to different land use of watershed model

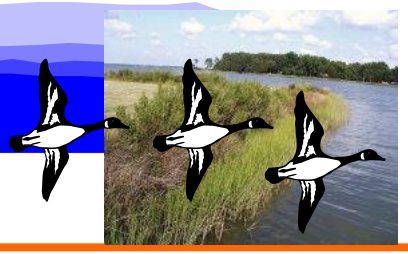


Non-Point Source

Farming: Domestic animals



Point Source



Wetland

Watershed Model Development

- Convert source estimation to loading and input to watershed model
- Simulate flow and non-point source loading by each subwatershed
- Conduct watershed model calibration
- Provide daily loading to 3D model

Influence of Withdrawal of Freshwater

Current withdrawal – average annual reported values

Watershed runoff

Actual Stage

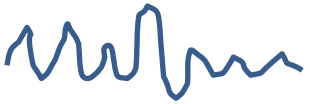
Outflow (Provided by Newport News)

Watershed runoff

Hypothetical Stage

Within TMDL model perform comparisons using hypothetical withdrawal values

Outflow (Estimated by model)



watershed

Conduct model sensitivity using different withdrawals to evaluate overall bacteria concentrations.

Public Participation Steps

- **First Public Meeting** (7/28/2015)
  - Shared and gathered information
  - Public comment period ended 08/29/2015

- **Technical Advisory Committee** (10/07/2015)
  - Review the draft source assessment estimates
  - Gather feedback and technical advice
  - Discuss the next steps of TMDL development

- **Final Public Meeting** (late 2015/early 2016)
  - Report TMDL results and post draft TMDL document on the DEQ website
  - Public comment period on draft TMDL

Questions, Comments, and Information

- Contribute your input and questions on bacteria sources
  - Wildlife density, livestock, failing septic facilities, etc.
- Loading estimation
- TMDL calculation
- Other questions/comments

This presentation will be made available at the DEQ web site at:

www.deq.virginia.gov

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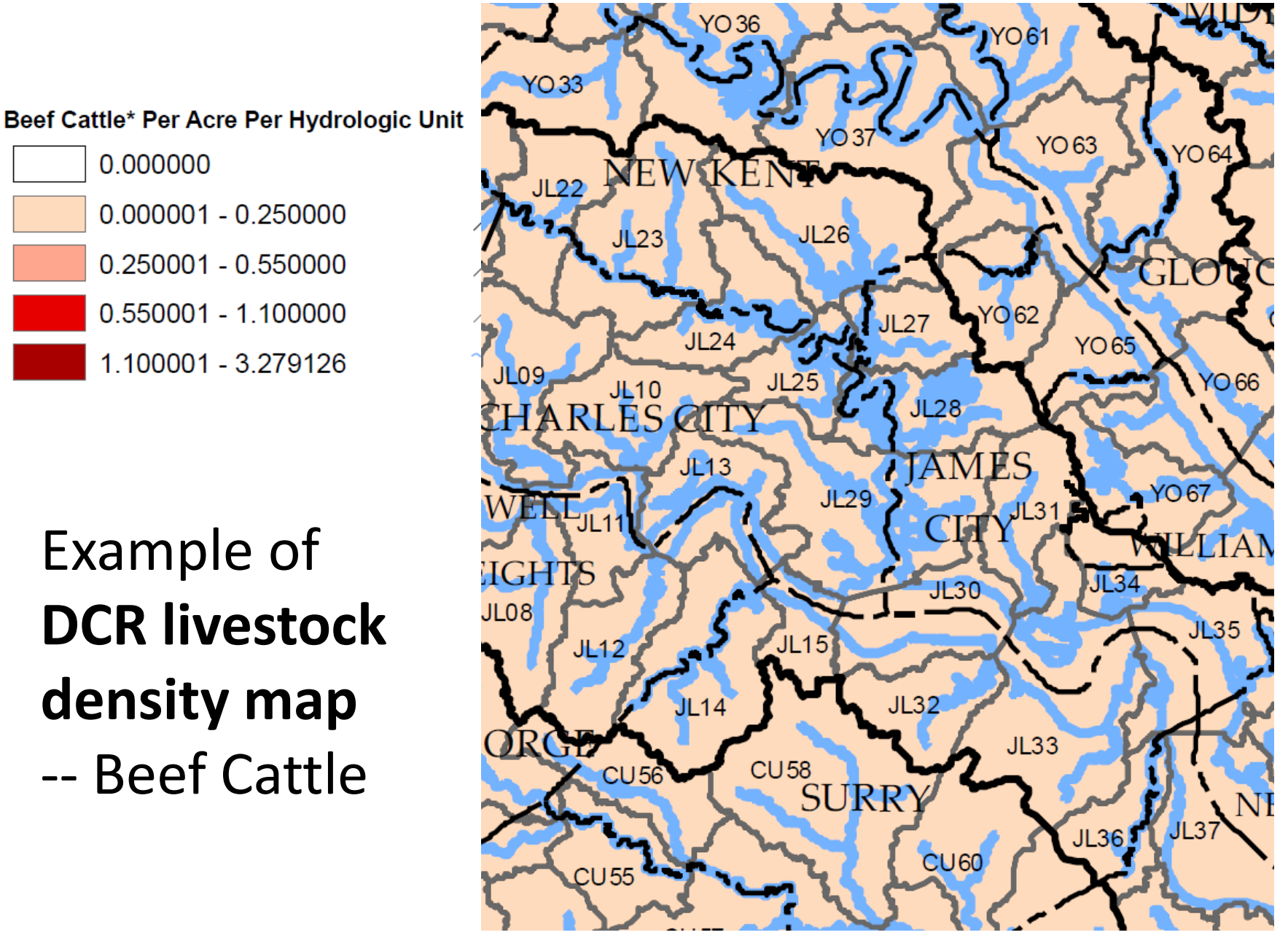
Thanks!

Appendix Slides



Example of **DCR livestock density map** -- Beef Cattle

Summary of Source Assessment -- by Impaired Water

Diascund Creek (Non-tidal)			
Source		Livestock (Horse Only)	All Livestock
Wildlife	Deer	434	434
	Duck	63	63
	Goose	81	81
	Beaver	33	33
	Raccoon	449	449
	Muskrat	8,220	8,220
	Total	9,281	9,281
Pet	Dogs	371	371
Septic		812	812
Marina		-	-
Livestock		34	151
Total		10,499	10,615

Chickahominy River			
Source		Livestock (Horse Only)	All Livestock
Wildlife	Deer	3,971	3,971
	Duck	629	629
	Goose	809	809
	Beaver	1,120	1,120
	Raccoon	4,184	4,184
	Muskrat	168,488	168,488
	Total	179,199	179,199
Pet	Dogs	2,136	2,136
Septic		4,956	4,956
Marina		145	145
Livestock		556	1,455
Total		186,993	187,891

Beaverdam Creek			
Source		Livestock (Horse Only)	All Livestock
Wildlife	Deer	135	135
	Duck	19	19
	Goose	25	25
	Beaver	21	21
	Raccoon	136	136
	Muskrat	2,893	2,893
	Total	3,230	3,230
Pet	Dogs	101	101
Septic		220	220
Marina		-	-
Livestock		8	43
Total		3,559	3,593

XAH-Beaverdam Creek, UT			
Source		Livestock (Horse Only)	All Livestock
Wildlife	Deer	64	64
	Duck	9	9
	Goose	12	12
	Beaver	11	11
	Raccoon	65	65
	Muskrat	1,381	1,381
	Total	1,543	1,543
Pet	Dogs	47	47
Septic		104	104
Marina		-	-
Livestock		1	15
Total		1,694	1,709

Diascund Creek (Tidal)			
Source		Livestock (Horse Only)	All Livestock
Wildlife	Deer	1,575	1,575
	Duck	245	245
	Goose	315	315
	Beaver	393	393
	Raccoon	1,660	1,660
	Muskrat	42,675	42,675
	Total	46,863	46,863
Pet	Dogs	998	998
Septic		2,714	2,714
Marina		-	-
Livestock		185	603
Total		50,760	51,178

Gordon Creek			
Source		Livestock (Horse Only)	All Livestock
Wildlife	Deer	93	93
	Duck	19	19
	Goose	25	25
	Beaver	67	67
	Raccoon	110	110
	Muskrat	7,995	7,995
	Total	8,308	8,308
Pet	Dogs	27	27
Septic		41	41
Marina		-	-
Livestock		5	26
Total		8,381	8,402

Barrows Creek			
Source		Livestock (Horse Only)	All Livestock
Wildlife	Deer	192	192
	Duck	25	25
	Goose	32	32
	Beaver	32	32
	Raccoon	133	133
	Muskrat	5,667	5,667
	Total	6,079	6,079
Pet	Dogs	78	78
Septic		119	119
Marina		-	-
Livestock		6	29
Total		6,281	6,305

Mill Creek			
Source		Livestock (Horse Only)	All Livestock
Wildlife	Deer	221	221
	Duck	38	38
	Goose	48	48
	Beaver	23	23
	Raccoon	241	241
	Muskrat	6,665	6,665
	Total	7,237	7,237
Pet	Dogs	82	82
Septic		400	400
Marina		-	-
Livestock		103	174
Total		7,822	7,893

Summary of Source Assessment -- by County

Charles City County			
Source		Livestock (Horse Only)	All Livestock
Wildlife	Deer	1,426	1,426
	Duck	194	194
	Goose	250	250
	Beaver	265	265
	Raccoon	1,320	1,320
	Muskrat	58,642	58,642
	Total	62,098	62,098
Pet	Dogs	781	781
Septic		646	646
Marina		70	70
Livestock		317	427
Total		63,912	64,021

James City County			
Source		Livestock (Horse Only)	All Livestock
Wildlife	Deer	1,314	1,314
	Duck	250	250
	Goose	321	321
	Beaver	483	483
	Raccoon	1,608	1,608
	Muskrat	79,133	79,133
	Total	83,108	83,108
Pet	Dogs	464	464
Septic		2,361	2,361
Marina		-	-
Livestock		161	653
Total		86,094	86,586

New Kent County			
Source		Livestock (Horse Only)	All Livestock
Wildlife	Deer	1,231	1,231
	Duck	185	185
	Goose	238	238
	Beaver	371	371
	Raccoon	1,256	1,256
	Muskrat	30,713	30,713
	Total	33,993	33,993
Pet	Dogs	891	891
Septic		1,949	1,949
Marina		75	75
Livestock		79	375
Total		36,987	37,284

Enterococci Impaired Waters

Stream and Assessment Unit	Impairment Description	Listing Date	County	Designated Uses
Chickahominy River G08E-04-BAC VAP-G08E_CHK02A00	The Chickahominy River from the confluence with Diascund Creek downstream to the James River. (5.92 mi^2)	2006	Charles City & James City	Recreation
Diascund Creek G08E-03-BAC VAP-G08E_DSC01A00	Diascund Creek from the Diascund Reservoir dam to the mouth at the Chickahominy River. (0.27 mi^2)	2010	James City & New Kent	
Gordon Creek G08E-05-BAC VAP-G08E_GOR01A06	Tidal limit to mouth (0.2 mi^2)	2012	James City	

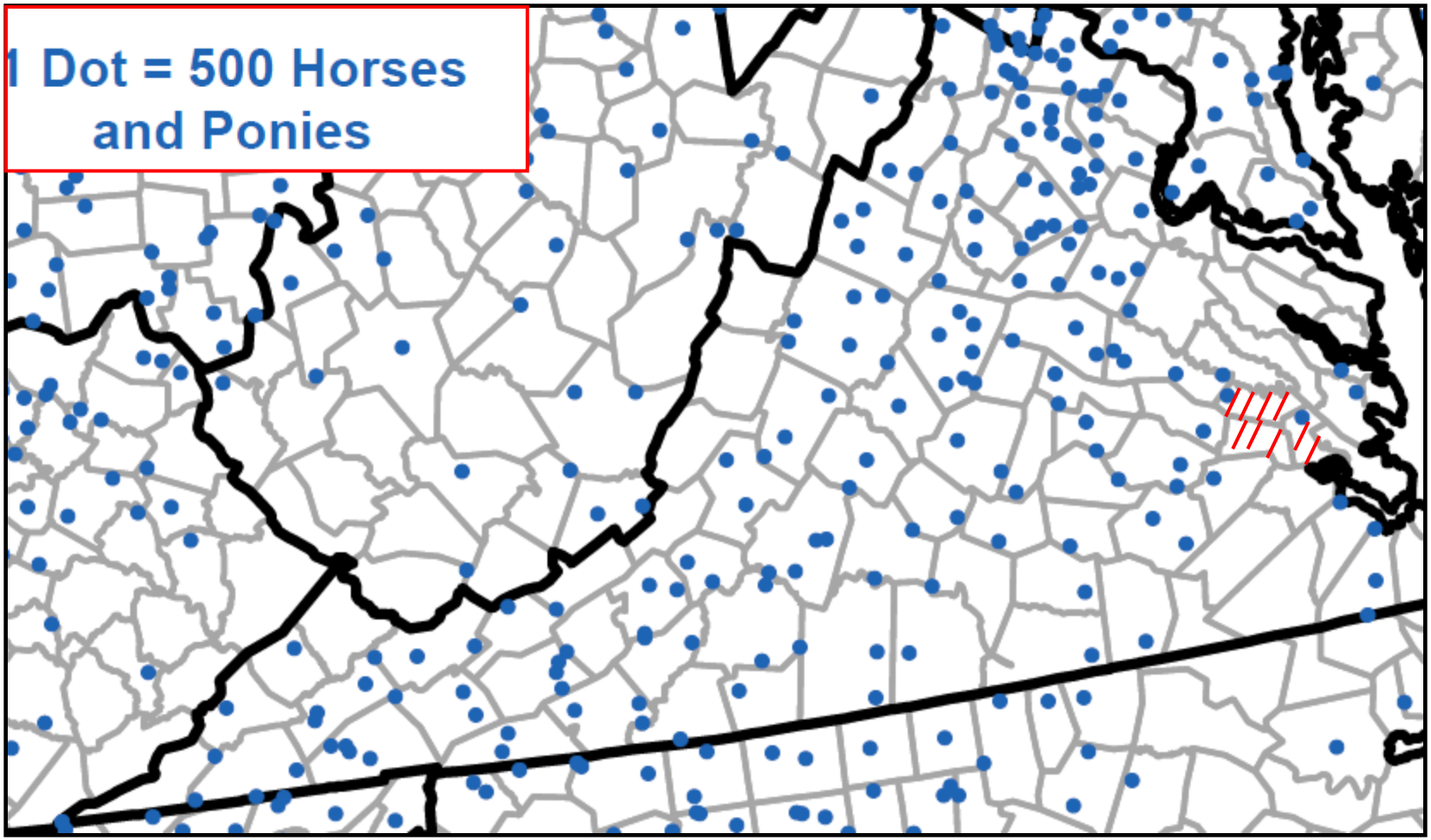
E. coli Impaired Waters

Stream Name and Assessment Unit	Impairment Description	Listing Date	County	Designated Use
Beaverdam Creek G09R-01-BAC VAP-G09R_BDM01A98	Beaverdam Creek from its headwaters to the upstream limit of Diascund Reservoir. (4.34 mi^2)	2012	New Kent	Recreation
XAH-Beaverdam Creek, UT G09R-06-BAC VAP-G09R_XAH01A12	Headwaters to mouth at Beaverdam Creek. (2.23 mi^2)	2012		
Diascund Creek G09R-02-BAC VAP-G09R_DSC01A00	Diascund Creek from its headwaters to the upstream limit of Diascund Creek Reservoir. (6.88 mi^2)	2008		
Mill Creek G08R-02-BAC VAP-G08R_MCR01A04	Mill Creek from its headwaters downstream to its tidal limit. (4.81 mi^2)	2004	James City	
Barrows Creek G08R-05-BAC VAP-G08R-BRW01A14	Headwaters to tidal limit. (6.93 mi^2)	2014	Charles City	

Horses

- Based on the field survey, no other livestock were seen in the watershed except horses. Therefore the livestock number estimation with horses only are included here for comparison.

National Horse Density Distribution

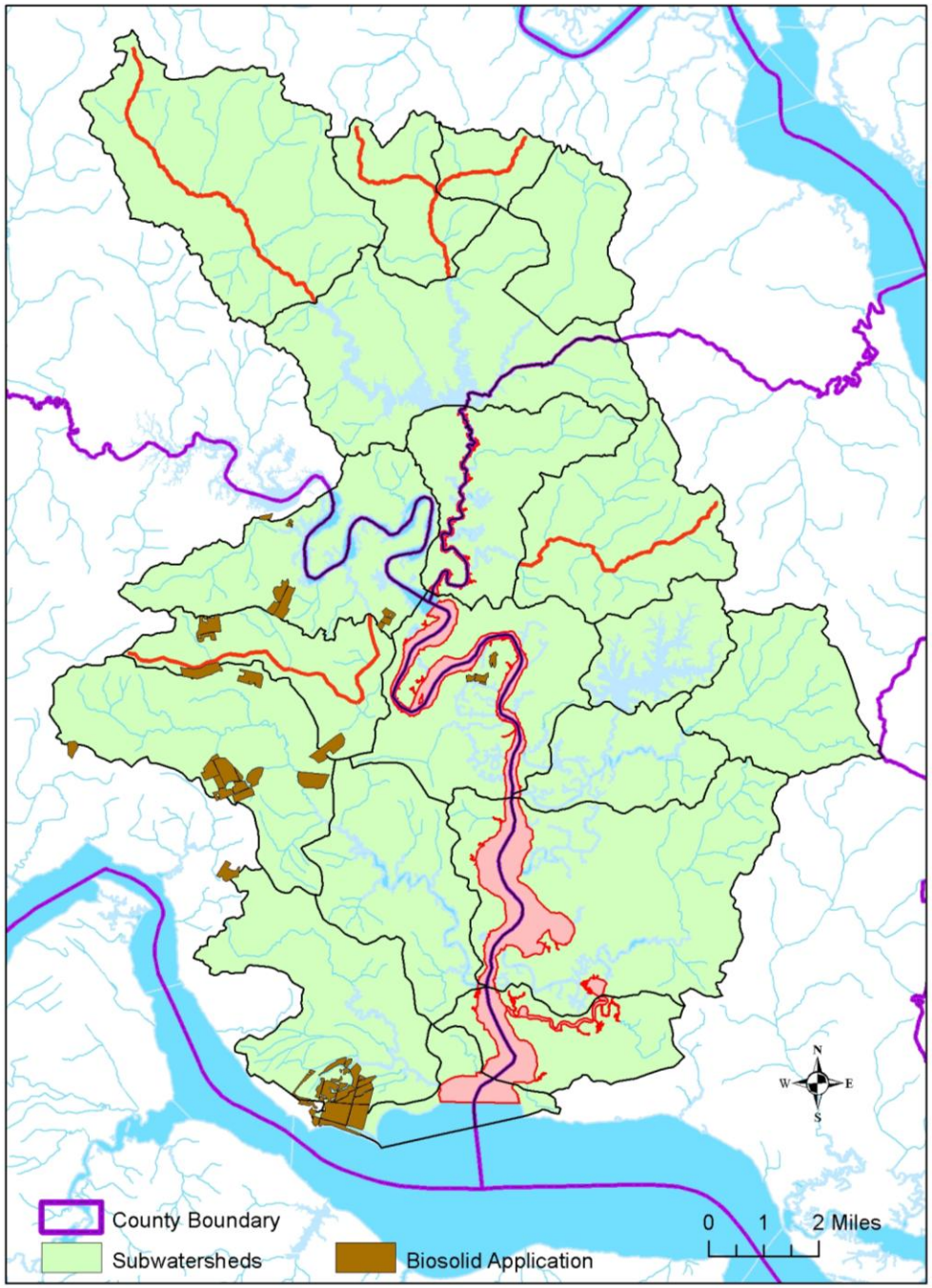


Point Source – Biosolids

Total Area of Application

=

1503.5 Acres



Water Quality Criteria

Use	Indicator Bacteria	Criteria
Recreation	*E. Coli* (freshwater)	Geometric Mean 126 counts/100ml * Single Sample Maximum 235 counts/100ml
	Enterococci (transition & salt water)	Geometric Mean 35 counts/100ml * Single Sample Maximum 104 counts/100ml

- *If there are insufficient data to calculate monthly geometric means in freshwater, no more than 10% of the total samples in the assessment period shall exceed 235 E.coli counts/100 ml .*

*** If there are insufficient data to calculate monthly geometric means in transition and saltwater, no more than 10% of the total samples in the assessment period shall exceed enterococci 104 counts/100 ml.*